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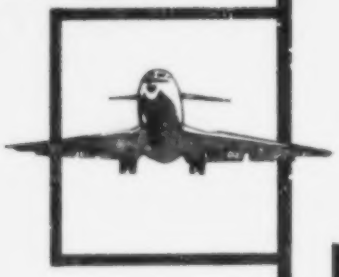

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NATIONAL TRANSPORTATION SAFETY BOARD

PB82-916401

WASHINGTON, D.C. 20594

MARINE ACCIDENT REPORT

COLLISION OF
NORWEGIAN CARGO VESSEL
M/V HØEGH ORCHID
AND NEW YORK FERRY
AMERICAN LEGION
UPPER NEW YORK BAY
MAY 6, 1981

NTSB-MAR-82-1

UNITED STATES GOVERNMENT

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16. Abstract

About 0716 e.d.t. on May 6, 1981, the Norwegian cargo vessel M/V HØEGH ORCHID, inbound from sea to a berth in Brooklyn, opposite The Battery, collided with the New York City ferry AMERICAN LEGION in dense fog in Upper New York Bay near buoy No. 24. The ferry was en route from Staten Island to Manhattan with approximately 2,400 passengers aboard. The ferry was damaged from below the main deck up to and including the bridge deck, the uppermost passenger deck. A total of 71 passengers were treated for injuries; 3 passengers were hospitalized. The HØEGH ORCHID suffered minor damage, and there were no injuries to persons aboard. The estimated cost of repairs to both vessels was $520,000.

The National Transportation Safety Board determines that the probable cause of the accident was the excessive speed of the HØEGH ORCHID in dense fog and the failure of the master of the ferry AMERICAN LEGION and the pilot of the HØEGH ORCHID to properly evaluate the information displayed on their radarscopes and take appropriate action to avoid collision. Contributing to the accident was the failure of the pilot of the HØEGH ORCHID to establish radio communication with the AMERICAN LEGION in order to establish a meeting agreement after becoming aware that the ferry was entering the main shipping channel.

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NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

MARINE ACCIDENT REPORT

Adopted: February 2, 1982

NORWEGIAN CARGO VESSEL M/V HØEGH ORCHID AND NEW YORK CITY FERRY AMERICAN LEGION COLLISION, UPPER NEW YORK BAY MAY 6, 1981

INTRODUCTION

This accident was investigated jointly by the National Transportation Safety Board and the U. S. Coast Guard. Public hearings were held in New York, New York, from May 8, 1981, through May 18, 1981, and on July 23, 1981. This report is based on the factual information developed by the investigation. The Safety Board has considered all facts pertinent to the Safety Board's statutory responsibility to determine the cause or probable cause of the accident and to make recommendations.

The Safety Board's analyses and recommendations are made independently of the Coast Guard. To insure public awareness of all Safety Board recommendations and responses by the Coast Guard, all such recommendations and responses are published in the Federal Register.

SYNOPSIS

About 0716 e.d.t. on May 6, 1981, the Norwegian cargo vessel M/V HØEGH ORCHID, inbound from sea to a berth in Brooklyn, opposite The Battery, collided with the New York City ferry AMERICAN LEGION in dense fog in Upper New York Bay near buoy No. 24. The ferry was en route from Staten Island to Manhattan with approximately 2,400 passengers aboard. The ferry was damaged from below the main deck up to and including the bridge deck, the uppermost passenger deck. A total of 71 passengers were treated for injuries; 3 passengers were hospitalized. The HØEGH ORCHID suffered minor damage, and there were no injuries to persons aboard. The estimated cost of repairs to both vessels was $520,000.

The National Transportation Safety Board determines that the probable cause of the accident was the excessive speed of the HØEGH ORCHID in dense fog and the failure of the master of the ferry AMERICAN LEGION and the pilot of the HØEGH ORCHID to properly evaluate the information displayed on their radarscopes and take appropriate action to avoid collision. Contributing to the accident was the failure of the pilot of the HØEGH ORCHID to establish radio communication with the AMERICAN LEGION in order to establish a meeting agreement after becoming aware that the ferry was entering the main shipping channel.

INVESTIGATION

The Accident

HØEGH ORCHID.--On May 6, 1981, at 0518 1/ the Norwegian cargo vessel M/V HØEGH ORCHID arrived at the pilot station off Ambrose light tower at the entrance to New York Harbor, in dense fog, after a 2-day voyage from Halifax, Nova Scotia, Canada. It was partially loaded with general cargo, latex in bulk, and some containers on deck. At 0555, according to the ship's bellbook, its engines were stopped and a Sandy Hook pilot 2/ boarded to pilot the vessel into the harbor. The pilot later testified that the vessel at this time was "1 mile east" of the sea buoy at the entrance to Ambrose Channel. After arriving on the bridge of the HØEGH ORCHID, the pilot introduced himself to the ship's master and requested permission to assume the conn. Although the master's native language was Norwegian, he spoke very good English. Also on the bridge were the chief officer and the helmsman. A lookout was posted on the bow. The vessel was still in international waters and, because of the limited visibility, the required fog signal was sounded every 2 minutes. As the vessel crossed the demarcation line into inland waters, the interval between fog signals was changed to every minute in compliance with the Inland Rules of the Road.

After the pilot and the master discussed the visibility conditions, the radar, the traffic in the area, and the vessel's maneuvering characteristics, such as the type of engine and the speeds that the vessel could make at the various bridge control settings, they agreed that a speed of half ahead, or 12 knots, would be suitable.

The HØEGH ORCHID was equipped with two radars, both of which were in operation. The pilot checked both radars and was satisfied that he could proceed safely. The radar units were positioned side by side on the starboard side of the wheelhouse slightly aft of the helm. When the pilot boarded, the 3-cm radar was set on the 3-mile range and the 10-cm radar was on the 8-mile range. As the vessel entered the 2,000-foot-wide Ambrose Channel, the 3-cm radar was changed to the 1 1/2-mile range and the 10-cm radar to the 4-mile range. Although most of the time the pilot used the 3-cm radar while the master used the 10-cm radar, they frequently alternated because the radars were beside each other.

The dialogue between the master and the pilot thereafter consisted of exchanging radar information and the passing of lookout reports. The pilot directed the navigation of the vessel during the entire period until he was relieved by the docking pilot near the berth at Pier 9, Brooklyn. The pilot gave helm orders directly to the helmsman and engine orders to the chief officer in English. The master continually observed the helmsman's response to insure that the helm orders were executed promptly and correctly.

After the pilot assumed the conn of the HØEGH ORCHID, the master continued to verify the vessel's position using the radar and the reports of bells and whistle sounds of the channel buoys. He testified that he was familiar with the portion of New York Harbor from the Verrazano-Narrows Bridge to The Battery. After his initial discussion with the master regarding the vessel's speed, the pilot chose the courses and speeds used during the inbound transit.

1/ All times are eastern daylight based on a 24-hour clock unless otherwise noted.
2/ New York/New Jersey Sandy Hook Pilot's Association.

The chief officer's duties included the operation of the engine controls, keeping the bellbook, and marking the times of the vessel's position on the navigation chart. At about 0630, the first officer was called to stand by the anchors forward and relieve the lookout. (Norwegian vessels carry a chief officer and a first officer.) He arrived on the bow about 0635 followed shortly thereafter by the ship's carpenter. The first officer testified that although he did not visually sight any buoys because of the fog, he did report the sounds of whistle buoys and bell buoys to the bridge. The only object that was visible to him before the ferry sighting was a faint outline of the Verrazano-Narrows Bridge as the HØEGH ORCHID passed under it. Communication between the bow and the bridge was by portable radio.

The HØEGH ORCHID was equipped with a VHF radiotelephone, tuned to both channels 13 and 16. 3/ It was set to transmit on channel 13 while the button on the handset was depressed and to receive on channels 13 and 16 when the button was released. Although there was a second VHF radiotelephone installed in the wheelhouse, it was not operable. The pilot's portable radio was also tuned to channel 13, the bridge-to-bridge frequency.

As the vessel proceeded inbound towards The Narrows (see figure 1), there was another vessel ahead about 3 to 4 nmi, also inbound, later identified as the TILLY. The first officer on the bow reported several fog signals which came from the port side from a tug and tow. The pilot stated that although he saw a contact on his radar resembling a tug and tow, he was unable to contact it on his radio. In the vicinity of Gravesend Bay, the sounding of the HØEGH ORCHID's fog signal was changed from automatic to manual operation.

At 0701, as the HØEGH ORCHID passed under the Verrazano-Narrows Bridge, the pilot used his portable radio to broadcast a security call over channel 13: "Security, security. This is the HØEGH ORCHID inbound passing under the Verrazano Bridge." The pilot testified that he made several calls after the one at 0701, but the transcript of the Coast Guard Vessel Traffic Center (VTC) recording of channel 13 communications on May 6 did not reveal any. It is possible that because his portable radio transmitted only in a low-powered mode his subsequent security calls may have been overriden by high-powered VHF transmissions from another source, preventing both the VTC and the master of the AMERICAN LEGION from hearing the calls. According to the pilot, he passed under the center of the bridgespan on a course of 335°. 4/ At 0702, the vessel's speed was reduced to slow ahead (9 knots) and then immediately to dead slow ahead (5 knots). Between 0703 and 0705, the pilot used his portable radio to contact, on channel 13, the TILLY, which was near buoy No. 20A, about 0.4 nmi ahead. The pilot of the TILLY informed him that his vessel would be heading for the Bay Ridge Channel on the Brooklyn side of the harbor. (See figure 2.) These communications appeared in the VTC recording transcript. At 0706, as the TILLY rounded buoy No. 20A, the HØEGH ORCHID's pilot increased speed to half ahead (12 knots) to give his vessel a "kick" ahead for a more rapid acceleration, and then reduced the speed to slow ahead (9 knots). As he approached buoy No. 20A, the pilot kept the HØEGH ORCHID to the left of center of the channel to give the TILLY a wide berth. Using the information on the ship's radar, the pilot then shaped his course for buoy No. 24, estimating that he would pass both buoys Nos. 22 and 24 approximately the same distance off.

3/ All radiotelephone channels referred to in this report are VHF-FM.
4/ All courses are true unless otherwise noted.

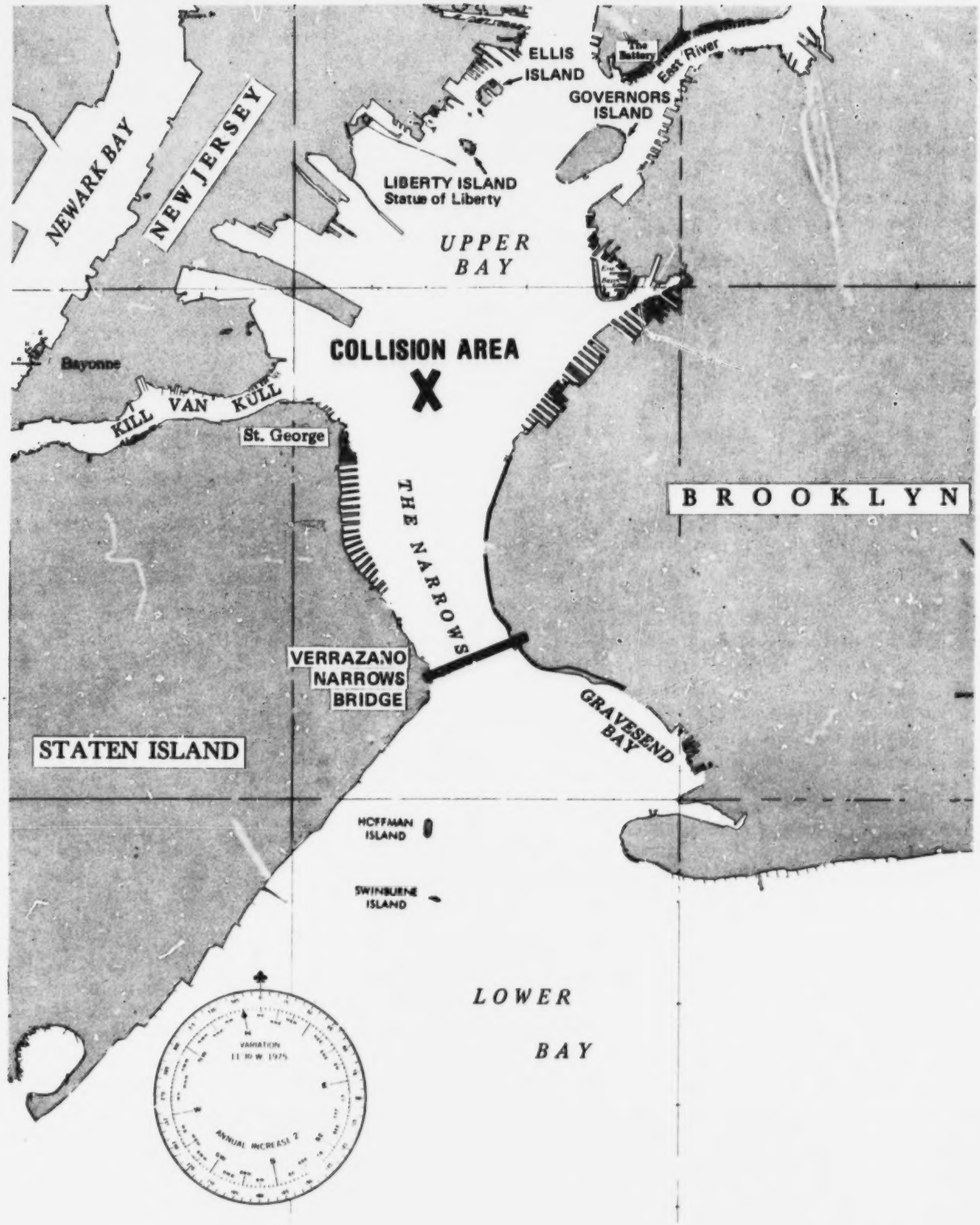

Figure 1.--Chart of New York Harbor.

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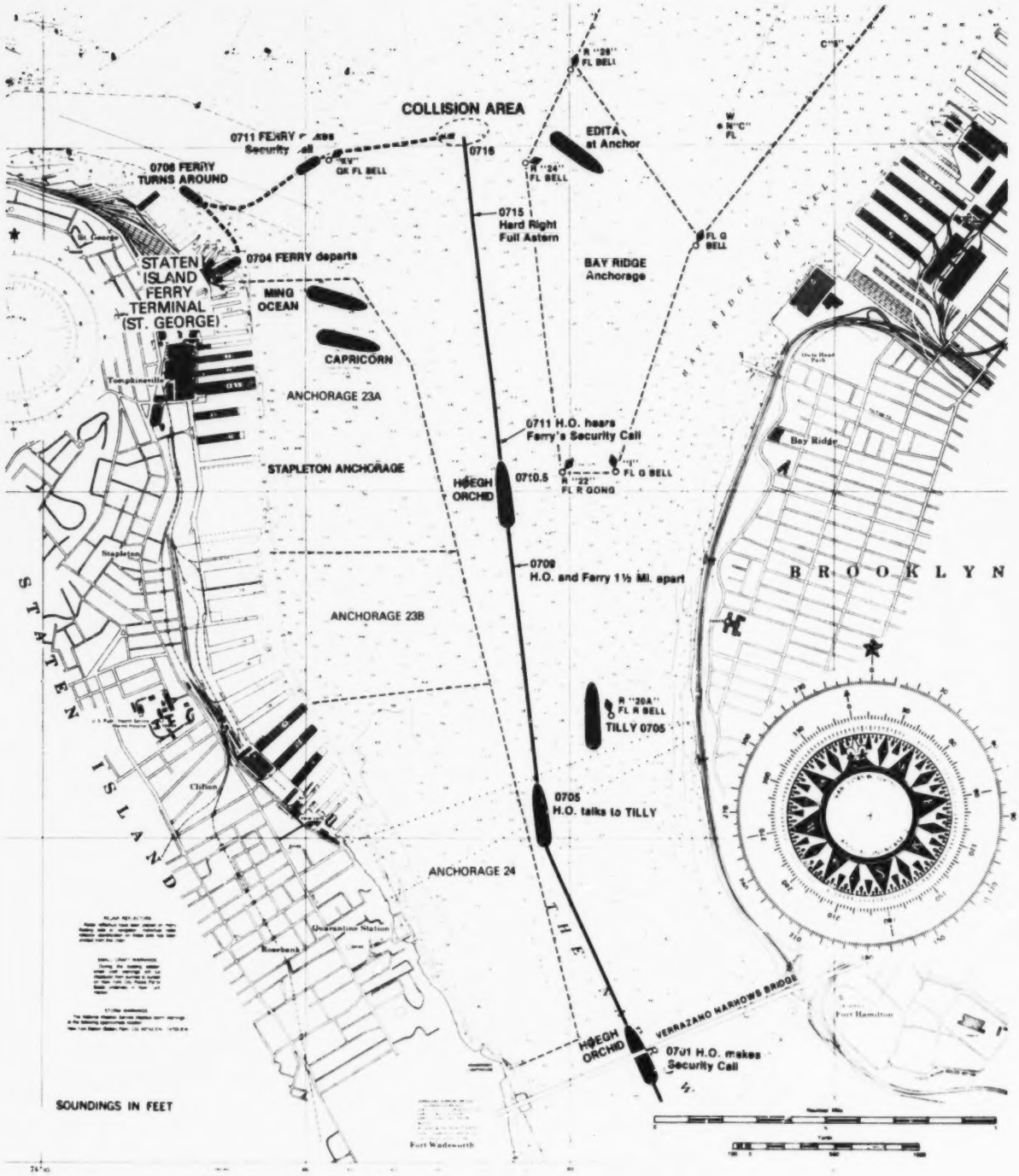

Figure 2.--Chart of Upper New York Harbor showing vessels' approximate tracklines and area of collision.

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The radar indicated several ships anchored in the Stapleton anchorage off Staten Island, two of which were quite close to the northern end of the anchorage. A vessel, later identified as the MING OCEAN, was anchored just off ferry slip No. 6, the most southerly slip in the Staten Island ferry terminal. There was a tug and a tow approaching buoy No. 24 heading east towards Bay Ridge. Across the channel in the Bay Ridge anchorage, several other ships were anchored. One vessel, later identified as the EDITA, a small container ship, was anchored about 300 to 400 yards east of buoy No. 24. (See figure 2.)

Although the VTC transcript indicated three security calls from the ferry AMERICAN LEGION at 0704, 0706, and 0711, the pilot of the HØEGH ORCHID recalled hearing only two. The first one he heard referred to the ferry "maneuvering off St. George" 5/ at 0706 and the second one: "Security call, Ferryboat AMERICAN LEGION coming up on the KV buoy heading for buoy 24" at 0711. The HØEGH ORCHID's estimated position at that time was near buoy No. 22, or about 1 mile from the ferry's estimated position. At about 0714, the fog signal of the AMERICAN LEGION was heard forward of the port beam by the pilot of the HØEGH ORCHID. He then observed a radar contact on his port bow on the 3-cm radar at 0.4 nmi. He immediately ordered the engine stopped and full astern, the helm "hard a starboard," and the danger signal sounded, followed by three short blasts on the ship's whistle. The first officer on the bow visually sighted the ferry approaching from the port side about 300 feet off. He reported to the bridge, "Ship coming in from the port. Hard starboard." The helm by this time was hard to starboard and the engines were going full astern. At 0716, the HØEGH ORCHID and the AMERICAN LEGION collided near buoy No. 24 in the main ship channel.

AMERICAN LEGION.--At 0600 on May 6, 1981, the ferry AMERICAN LEGION was berthed at slip No. 5, Staten Island ferry terminal. It had been in idle status since about 2330 the previous day. The ferry crew was reporting aboard to prepare for the first trip of the day. The deck crew consisted of the master, assistant captain (pilot), one mate, and six deckhands. The master reported aboard a few minutes after 0600 and began his normal routine duties including checking the vessel's log for anything unusual that the crew of the previous day may have noted. He found a note in the log that the radar on the "New York end" was not operating. (The AMERICAN LEGION is a double-ended ferry, with two identical pilothouses.) According to the log, the radar had been out of service since May 4. He went to the pilothouse on the "Staten Island end" and placed the radar there in operation, observing that it appeared to be in working order. The master then notified the ferry dispatcher in the Staten Island ferry terminal by radio that because the radar on the New York end was not operable, he would turn the vessel around immediately upon leaving the slip to make the Staten Island end the working pilothouse. The dispatcher agreed and, accordingly, no vehicles were loaded for the trip, thus eliminating the problem of backing them off at the Manhattan ferry terminal. The pilot was informed of the plan by the master who ordered him to the pilothouse on the New York end.

The AMERICAN LEGION departed the Staten Island ferry terminal at 0704 in dense fog with the master in the pilothouse on the Staten Island end at the engine controls and directing the pilot in the New York end, by prearranged buzzer signals, as to what rudder to apply, i.e., one buzz for hard right rudder, two buzzes for hard left rudder, and three buzzes for rudder amidships. The same signals were used for answering. As soon as the ferry cleared the racks, 6/ it turned left into Kill Van Kull (see figure 2) keeping close to

5/ Area of Staten Island where the ferry terminal is located.
6/ The fendering system used to guide the ferry into the slip.

the piers north of the terminal. A security call was broadcast by the master over channel 13 at the same time: "Security call. Ferryboat AMERICAN LEGION leaving St. George ferry slips. Maneuvering off of St. George, maneuvering off of St. George." When the ferry was parallel to the shore, the master ordered the pilot to put his helm amidships and then signaled the mate on the main deck at the Staten Island end to have the rudder locking pin dropped in place to lock the rudder in the amidships position. Because this end was now the forward end of the vessel, the rudder had to be locked firmly in place before the vessel gained any forward momentum. After securing the steering engine for the forward rudder, the pilot went to the pilothouse on the Staten Island end and relieved the master at the helm and engine controls. The master continued to conn the vessel, monitor the radar, and make security calls on the radiotelephone.

After the pilot arrived in the pilothouse on the Staten Island end, the engines were placed on slow ahead and the helm hard left. The master identified the KV buoy on radar and ordered the pilot to steer a course of east-northeast (067 1/2°) 7/ towards the buoy, now only about 1/8 mile distant. Another security call was made by the master and recorded by the VTS log recorder at 0706: "Security call. Ferryboat LEGION maneuvering off of St. George ferry slips." The mate and two deckhands were posted on the main deck forward, two deckhands were posted on the upper deck forward, and one deckhand was on the port bridge wing outside the pilothouse, all as lookouts. The master testified that he sounded fog signals regularly.

As the ferry proceeded in the direction of the KV buoy at slow speed, approximately 3 knots, a lookout on the main deck sighted the buoy on the ferry's starboard bow at about 40 to 50 feet off. The master then ordered the pilot to steer east when the buoy came abeam to starboard. A fog signal was heard on the port beam and was determined to be coming from a radar contact at about 1/2 mile off. It was identified as coming from the ferry VERRAZANO en route to Staten Island. The AMERICAN LEGION's master testified that while he was looking at the radar, which was set on the 1-1/2 mile range, he saw another contact off to starboard about 1/2 mile distant, which did not appear to be moving. He said he could not identify it as a "definite target." He ordered the engines stopped, and at 0711 he broadcast another security call over channel 13: "Security call. Ferryboat AMERICAN LEGION coming up on the KV buoy heading for buoy 24." The ferry master testified that he did not plot any contacts on the radar, and that it was not done in New York Harbor. As the ferry passed the KV buoy to starboard, the pilot changed course to the right to a compass heading of east (090°). Although the engines were stopped, there was sufficient steerageway to enable the pilot to change course and steady up on the new heading. The master testified that he observed the heading flasher on his radar lying between buoys Nos. 24 and 26, about 0.2 mile north of buoy No. 24 after the ferry was on the new heading.

While the AMERICAN LEGION was still drifting on the easterly heading, both the master and the pilot heard the fog signal of the VERRAZANO now on their port quarter. At this time the master ordered the pilot to "come left and slow ahead." Before the order was carried out, the master noticed the target off to starboard was closer and ordered the engines stopped. The ferry's compass heading was now "east a half north" (078 3/4°). According to the master, when the unidentified contact previously seen off to starboard was 1/8 mile off, it appeared to be moving. The master said he sounded a fog signal but did not hear any reply. He said he concluded that the contact did not pose a threat to his

7/ The ferry master and ferry pilot were using points instead of degrees when steering by magnetic compass.

vessel. At this time a lookout on the upper deck shouted "ship on the starboard beam." The master, also sighting the HØEGH ORCHID approaching on the ferry's starboard beam, immediately ordered "hard right and full ahead." As soon as the order was executed, the master relieved the pilot at the helm.

At 0716, as the ferry started to swing to the right, it was struck on the starboard side by the HØEGH ORCHID, approximately 50 feet aft of midships. (See figure 3.) The ferry heeled to port due to the force of the impact and then righted itself. The ferry master stopped the engines and directed the pilot not to move the vessel until the extent of the damage could be determined. The vessels remained together for about 4 minutes until the HØEGH ORCHID backed clear of the ferry. The ferry pilot received a report from the engineroom giving the extent of the damage below, that the ferry was not taking any water, and that no one in the engineroom suffered any injuries.

A Sandy Hook pilot aboard the EDITA anchored in the Bay Ridge anchorage east of buoy No. 24 observed the situation on his radar and heard the communications on channel 13 on his portable radio. He stated that he became alarmed over the events that were developing and tried to call the HØEGH ORCHID, although he did not know its name. The VTC transcript showed transmissions from the pilot of the EDITA calling "the vessel inbound at the 22 buoy main ship channel" at 0710 1/2 and "calling the vessel inbound abeam of the 22 buoy" at 0712.

After two attempts to call the HØEGH ORCHID, he said he called the AMERICAN LEGION by name over channel 13, and again received no response. This transmission was not found on the VTC transcript. After hearing the sounds of a collision, which were clearly audible to him, that of breaking glass together with a "crunching" sound, the EDITA's pilot ordered the tug HELEN MACALLISTER, one of two tugs which were lying alongside the EDITA, to proceed to the AMERICAN LEGION and to offer assistance. Using his radar, he directed the tug to the scene. He then switched his vessel's VHF radio to channel 12 and notified the VTC that he had observed a collision near buoy No. 24 and had dispatched a tug to assist.

Actions of Vessels After Collision

HØEGH ORCHID.-- Beginning at 0718, 2 minutes after the collision, the HØEGH ORCHID's pilot attempted numerous times to contact the AMERICAN LEGION on channel 13 using his portable radio. These transmissions were found on the VTC transcript. The ferry never responded. At 0720, the vessels separated and the engine on the HØEGH ORCHID was stopped. The vessel drifted astern for about 5 minutes before the next engine order was given. At 0725, the pilot ordered slow ahead to check the sternway and then ordered right rudder. The bow thruster was used to assist the vessel to swing to starboard.

At 0723, the pilot used the ship's VHF radiotelephone and called "New York Traffic" on channel 12, the radio call sign of the Coast Guard VTC on Governor's Island, and reported a collision with a Staten Island ferry. The VTC replied that it had already notified Coast Guard Group New York. As the HØEGH ORCHID continued swinging to starboard, the first officer on the bow sighted the KV buoy about 50 feet off to port. The vessel then continued across the main ship channel until the pilot ordered left rudder and steadied up on a course of 022° and then 024°. Buoy No. 24 was sighted about 50 feet off to starboard as the HØEGH ORCHID proceeded up the east side of the channel to near Governor's Island where it met its tugs and boarded the docking pilot. After passing close to The Battery, the docking pilot assumed the conn and berthed the vessel at Pier 9, Brooklyn.

Figure 3.--Starboard side damage to the Staten Island ferry AMERICAN LEGION.

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AMERICAN LEGION.--Immediately after the collision, the master broadcast over channel 13: "have a little nit here." This transmission was recorded in the VTC. After instructing the pilot not to move the ferry, he ran out of the pilothouse into the passenger area on the bridge deck and told the passengers nearby to remain calm. Looking down from the bridge deck towards the bow of the HØEGH ORCHID, he could see daylight at the waterline and concluded that the AMERICAN LEGION was not damaged below the waterline. While returning to the pilothouse, he told the passengers that everything was fine and that they were returning to Staten Island. The master said he decided not to call the Coast Guard because "by the time the Coast Guard comes out here we will be in St. George and we are going to get men and boats out in this fog and it is going to cause more confusion." He did not make any announcements over the public-address system to avoid causing any panic among the passengers.

The mate of the HELEN MACALLISTER first sighted the port side of the AMERICAN LEGION and then passed around the ferry's stern to the starboard side. He also sighted two lifejackets floating in the water. The ferry master waved him off, indicating he did not require any assistance. The AMERICAN LEGION started back to Staten Island. As buoy No. 24 came into sight, the ferry started to swing to the right. It came close to the EDITA, which was anchored east of buoy No. 24 (see figure 2). The pilot of the EDITA sighted the ferry visually for several minutes off his starboard quarter. He requested the HELEN MACALLISTER to keep the ferry away from the EDITA as it was only 75 to 100 feet off. The main engine of the EDITA was used to move it ahead on its anchor chain in order to give the ferry additional clearance during the near approach. The ferry backed clear and disappeared into the fog. As the ferry approached Staten Island, the mate reported to the pilothouse by telephone that an ambulance was required when they reached the terminal. Three injuries were reported at that time to the ferry dispatcher at the Staten Island ferry terminal via channel 19A, the working channel for the New York City ferry system. The AMERICAN LEGION berthed in slip No. 3 at 0740 and discharged its passengers.

Injuries to Persons

Injuries	HØEGH ORCHID	AMERICAN LEGION	Total
Fatal	0	0	0
Nonfatal	0	71	71
Minor/none	37	2,282 1/	2,319 1/

1/ Estimated figure.

Damage to Vessels

HØEGH ORCHID.--The bow of the HØEGH ORCHID was damaged between the 27-foot and 33-foot levels on the port and starboard sides. The stemplate was crushed and pushed over to starboard. Two shellplates on each side were torn aft about 6 feet 6 inches. The internal damage consisted of one breasthook torn and two "T" bar stiffeners bent and distorted. The safety railing on top of the bulwark on the forward part of the forecastle head was torn loose. The estimated cost of repairs was $20,000.

AMERICAN LEGION.--The superstructure was damaged on the starboard side from the main deck to the bridge deck. The steel and aluminum house was crushed to a depth of about 15 feet at the bridge deck level and to about 6 feet at the main deck level (see figure 3). The upper deck and the main deck were enclosed passenger areas while the bridge deck was an open passenger deck along the outboard side. The passenger benches in both these areas were torn loose and broken.

The hull below the main deck was holed just below the main deck in a 3-foot by 6-foot area. There was no penetration of the hull below the waterline. The extension of the main deck that forms the fender or rubbing bar remained intact after penetrating the stem of the HØEGH ORCHID. The estimated cost of repairs to the AMERICAN LEGION was $500,000.

Crew Information

HØEGH ORCHID.--The 36-man crew of the HØEGH ORCHID consisted of 12 Norwegian nationals, including the master, deck and engine officers, several key ratings in the engine department, and the chief steward; 1 Malaysian; and 23 Singaporean nationals.

The 59-year-old master had been sailing since 1937. He first went to sea in fishing vessels, followed by training aboard a sailing vessel. He had sailed for the Leif Høegh Company continuously since 1948. He earned his master's license in 1957 and had served as a master since 1960. He joined the HØEGH ORCHID as master in 1979.

The chief officer of the HØEGH ORCHID had been licensed by the Norwegian government as master, unlimited tonnage since 1979. He started his sea career in 1957, and had sailed as a licensed officer since 1970 with the Leif Høegh Company on various types of vessels. He joined the HØEGH ORCHID in March 1981. He was assigned to the watch from 0400 to 0800 and 1600 to 2000.

The first officer held a first mate's license issued by the Norwegian government in 1980. He earned his original license in 1977 and had sailed with the Leif Høegh Company ever since. As first officer aboard the HØEGH ORCHID, he was assigned to the watch from 0000 to 0400 and from 1200 to 1600 on May 6.

In addition to the ship's crew, a Sandy Hook pilot was also aboard. The pilot who was assigned to the HØEGH ORCHID on May 6, 1981, was a member of the New York/New Jersey Sandy Hook Pilot's Association. He held a U.S. Coast Guard license as master, any gross tons, endorsed as first-class pilot, any gross tons for the entire New York Harbor area, with an endorsement as a radar observer. He was issued his State pilot license in 1947 and had served as a New York Harbor pilot since then. He became a full pilot in 1953 for any vessel of any tonnage. He could not recall having piloted the HØEGH ORCHID before.

AMERICAN LEGION.--A 13-man crew operated the ferry on the morning of May 6, 1981, consisting of the master, the pilot or assistant captain, a mate, 6 deckhands, a chief engineer, an assistant engineer, and 2 oilers. The certificate of inspection for the AMERICAN LEGION requires a 13-man crew while carrying passengers or vehicles. An additional five persons are also permitted to be carried as part of the crew; they are usually concession attendants.

The master of the ferry was licensed by the U.S. Coast Guard as master of steam and motor vessels, any gross tons, upon bays, sounds, and lakes other than the Great Lakes and as a first-class pilot any gross tons, for New York Harbor above The Narrows to Elizabethport, New Jersey; to Yonkers on the Hudson River; to Harts Island in the East River; and for Staten Island sound from Robbin's Reef to Elizabethport. He also had an endorsement as radar observer, inland.

The ferry master had served 2 years in the U.S. Navy, followed by service in the merchant marine in an unlicensed capacity. In 1952, he was employed as a deckhand on the Staten Island ferries. He received his original license as a first-class pilot in 1956 and his master's license in 1961. He was made a permanent master in 1968 and had been employed in that capacity since then. Under the procedure used to assign the crews to the various ferries, he had served as master of each of the Staten Island ferries at one time or another.

The ferry master's Coast Guard license was renewed on March 20, 1981, in the port of New York. The renewal required an abbreviated rules of the road examination and a radar examination. The ferry master testified that when he took the Coast Guard radar examination, consisting mainly of radar plotting, for the required radar endorsement, he failed. He then studied on his own, attended a Coast Guard-approved radar school for a 1-day refresher course, passed the radar school's examination, and received a certificate for successfully completing its course. He then was able to renew his license by presenting the certificate to the Coast Guard license examiner in lieu of taking the Coast Guard radar examination.

In 1981, there were approximately 12 training schools that offered Coast Guard-approved radar training courses. The majority of these schools, including the one the ferry master attended, were operated by the U.S. Maritime Administration. In addition to providing training for those seeking an original radar endorsement, the school the ferry master attended offered a refresher course, including practical demonstration on a radar simulator, for endorsement renewals. Recent proposals by the Coast Guard to amend the regulations (CGD 76-193a) governing radar observer endorsement of merchant marine officers' licenses would require all applicants for radar endorsement to attend an approved radar school, which would include simulator training. Radar endorsement examinations presently given by the Coast Guard would not fulfill the requirements under the proposed amendment.

The pilot (assistant captain) also held a U.S. Coast Guard license as master, steam or motor vessels, any gross tons upon bays, sounds, and lakes other than the Great Lakes. His endorsements included radar observer, first-class pilot, steam or motor vessels, any gross tons, New York Harbor, Upper Bay, The Narrows to The Battery; East River, The Battery to Execution Rocks; Staten Island Sound, Robbin's Reef to Elizabethport, New Jersey, and first-class pilot, steam and motor ferry vessels, any gross tons, Hudson River, The Battery to the George Washington Bridge, and first-class pilot, Lower Bay and The Narrows to the sea.

The pilot served as a seaman in the U.S. Navy and was employed as a deckhand on the Staten Island ferries in 1973. Although he received his first Coast Guard license in 1977, he was not employed as a pilot until 1978. He had served as pilot on each of the ferries operated by the city of New York.

Vessel Information

HØEGH ORCHID.--The motor vessel HØEGH ORCHID was built in 1968 in Abo, Finland, for the Leif Høegh Company of Oslo, Norway. It was lengthened in 1976 in Kobe, Japan. There are four sister ships of this type operated by the same company. The vessel's specifications are as follows:

Length overall	599.8 ft	(182.810 m)
Length between perpendiculars	560.4 ft	(170.810 m)
Breadth, molded	67.6 ft	(020.600 m)
Depth, molded	41.3 ft	(012.600 m)
Maximum draft	30.0 ft 10 in	(009.398 m)
Gross tonnage	12,081	
Deadweight tonnage	18,207	
Horsepower	9,600 at 119 rpm	

The vessel is powered by a six-cylinder, Sulzer diesel engine and is equipped with a KaMeWa controllable-pitch propeller with bridge control. Fifteen various pitch settings rather than adjustments of rpm are used to control the vessel's speed. Information on the propulsion settings is posted in the wheelhouse. (See appendix.) When maneuvering, it is not necessary to stop the main engine to maneuver from ahead to astern, but merely to change the pitch of the propeller. At sea, the vessel's machinery plant is equipped for 24 hours of unattended operation, i.e., an unmanned engineroom. To aid in maneuvering, the vessel is equipped with a bow thruster.

Although the HØEGH ORCHID is referred to as a general cargo vessel, it also has refrigerated cargo spaces, tanks for carrying latex in bulk, and fittings for carrying containers on deck. The vessel has five holds forward and one hold aft of the deckhouse. The navigating bridge is located aft over the engineroom.

The navigating equipment on the bridge included a magnetic compass; gyrocompass; electric steering stand; a 3-cm Raytheon radar, model 1220/6xB (x-band); a 10-cm Raytheon radar, model 1650 (S-band); two VHF-FM radiotelephones; speed log; fathometer with recorder; Decca receiver; loran-C receiver; radio-direction finder; and controls for the various systems aboard the vessel.

The HØEGH ORCHID's course recorder was not operational at the time of the accident. The vessel's master testified that it had not been used for a long time. As a result, there is no record of the courses the HØEGH ORCHID used during the morning hours of May 6.

AMERICAN LEGION.--The AMERICAN LEGION is a diesel-electric drive, double-ended, steel-hulled, passenger and vehicle ferry. It was built in 1965 in Orange, Texas, for the city of New York, and is operated by the city's Department of Marine and Aviation. It is one of three identical vessels, each certified to carry 3,533 passengers on three decks and vehicles on the main deck. It was designed to operate between the ferry terminals on Staten Island and Manhattan. The ferry's specifications are as follows:

Length overall	294 ft 0 in	(89.60 m)
Length between perpendiculars	268 ft 3 in	(81.80 m)
Breadth, molded	69 ft 0 in	(21.00 m)
Depth, molded	20 ft 7 in	(06.25 m)
Maximum draft	14 ft 3 in	(04.34 m)
Gross tonnage	2,109	
Horsepower	6,569	

The main deck is divided into two enclosed passenger cabins along each side with three vehicle lanes in the center. Both foot passengers and vehicles board and leave the ferry from this deck to the lower level of the terminal. The upper deck, referred to as the "saloon" deck on the older boats, is equipped for passenger seating only. The passenger area is enclosed except for an open deck on each end where passengers board from the upper level of the terminal. A snack bar and passenger facilities are located on this deck. The uppermost passenger deck is the bridge deck where there is open deck seating running the entire length of the deck on each side of the enclosed passenger cabin. A pilothouse is located on each end of the bridge deck. There is unobstructed visibility from each pilothouse in the direction the ferry is moving. The main deck and upper deck ends are visible from the pilothouse to give the master an unobstructed view of these areas during docking operations.

The double-ended ferry was designed to be operated from either pilothouse. Each pilothouse is equipped with the same navigating equipment and controls. Included are a magnetic compass; steering stand; control stand for main engine; engine order telegraph for engineroom control of main engines; one Raytheon 3-cm radar, model 1225/6xR; two Motorola VHF-FM marine radiotelephones equipped for channels 6, 13, 16, and 19A; a public-address system; sound-powered telephone; and controls and switches for the various systems aboard the vessel. A direction indicator is located in each pilothouse (the Staten Island end or the New York end) and in the engineroom to remind operating personnel which pilothouse is in control.

The U.S. Coast Guard granted a deviation 8/ from the requirements of the Navigation Safety Regulations, Title 33, Code of Federal Regulations, Part 164.35 for the ferries owned and operated by the city of New York on the Staten Island/Manhattan ferry route. Ferries may operate on this specified route without a gyrocompass, illuminated gyrocompass repeater, echo depth sounding device, and a device for recording soundings.

The main propulsion machinery consists of four diesel generators with two main motors for each propeller shaft. The propellers and shaft on each end are independently operated from the working pilothouse. When the ferry is operating at full ahead, the propeller that is at the bow is turning astern at about 15 to 20 percent of normal power to eliminate any drag that a stopped propeller would produce. However, when the engines are reversed when maneuvering in docking or stopping the vessel, maximum thrust is exerted by both propellers. When the stern propeller is stopped, the bow propeller also stops.

The two rudders operate independently of each other. The inactive or forward rudder is placed in the amidships position and a locking pin is manually dropped in position to prevent the bow rudder from swinging when underway. The steering engines on each end are then stopped or started accordingly. On the day of the accident, however, both rudders were used to turn the AMERICAN LEGION as it left the ferry slip at Staten Island; but the inactive rudder was locked immediately after the maneuver to clear the slip and before the direction was reversed.

Waterway Information

Upper New York Bay lies in generally a north-south direction, bounded by Brooklyn to the east, Staten Island to the southwest, and New Jersey to the northwest, with

8/ Letters to the Commissioner of Marine and Aviation, City of New York from the U.S. Coast Guard Captain of the Port of New York dated October 19, 1977, and December 5, 1978.

Governor's Island and the lower end of Manhattan to the north. (See figure 1.) From the Verrazano-Narrows Bridge at The Narrows, the distance to The Battery is approximately 6 nmi. The width of the main ship channel is about 1/2 nmi with depths ranging from approximately 80 feet at the center of The Narrows to about 48 feet off Robbin's Reef.

Entering the Upper Bay through The Narrows, the Stapleton anchorage is to the west, extending from near the Verrazano-Narrows bridge to the Staten Island ferry terminal at St. George, Staten Island. The Bay Ridge anchorage on the Brooklyn side extends from Bay Ridge to Erie Basin. Secondary channels connect the Upper Bay with various terminals in the harbor. The Kill Van Kull, at the northern end of Staten Island, connects the Upper Bay and Newark Bay in New Jersey. With oil refineries, container terminals, and shipyards located in this area, Kill Van Kull is one of the busiest secondary waterways in New York Harbor. Vessels must pass directly in front of the ferry slips at St. George when entering or leaving Kill Van Kull.

The Staten Island ferry routes to and from Manhattan generally use the main ship channel. (See figure 2.) From the Staten Island ferry terminal, the ferries normally head for buoy No. 24 to cross the main channel and then shape up on a course close to the east or in this case the "red side" of the channel. 9/ After passing Governor's Island, they turn to the east in the vicinity of the entrance range to the East River, then swing north again to make the approach to the ferry terminal at The Battery. After leaving the Manhattan terminal, the ferries turn west until they intersect a line along the west or "black side" of the channel, passing close to buoy No. 31 on a course to the KV buoy before turning towards the ferry terminal at St. George. Depending on the traffic in the harbor, the ferries generally stay to the right side of the channel.

The main channel is clearly defined by lighted buoys in the area of the ferry routes. In addition, there are other aids to navigation such as fixed lights on prominent points, channel ranges in the secondary channels, and fog horns located in various places around the harbor.

Environmental Information

On the morning of May 6, 1981, dense fog conditions existed at the pilot station when the HØEGH ORCHID arrived off the entrance to New York Harbor. The vessel had experienced fog during the entire voyage from Halifax, Nova Scotia. The wind was light and variable with a slight sea. The temperature was 48° F with zero visibility.

Dense fog conditions existed throughout the area including the Upper New York Bay. Visibility did not improve until about 1030, when those vessels anchored awaiting the fog to lift started to move.

Low water slack (no current) occurred at The Narrows at 0656 and east of Robbin's Reef at 0712. 10/

9/ The lateral system of buoyage is used on all navigable waters of the United States. Red buoys mark the starboard or right side of channels for an inbound vessel with even numbers which increase from seaward. Black buoys mark the port or left side of channels for an inbound vessel with odd numbers which increase from seaward.

10/ Tidal Current Tables, 1981, Atlantic Coast of North America.

Medical and Pathological Information

When the AMERICAN LEGION docked at the Staten Island ferry terminal, the injured passengers were taken to three hospitals in the area. The U.S. Public Health Service Hospital treated 43 persons of whom 3 were admitted and the remainder treated and released. St. Vincent's Hospital on Staten Island treated and released 19 persons while the Staten Island Hospital treated and released 9 persons.

Tests and Research

The Federal Communications Commission (FCC) dispatched a field inspector to check the VHF-FM radiotelephone equipment of both vessels. The inspection aboard the HØEGH ORCHID, termed a "disaster inspection" by the FCC inspector, concerned only the VHF installation. Its main radio station was closed down because the vessel was in inland waters at the time of the accident. The inspection included a check of the transmitter to determine if it was feeding sufficient power to the antenna, a check of the antenna system, a voltage check to determine power input, and frequency checks. The ship's radio operator accompanied the FCC inspector and activated the equipment for testing. The HØEGH ORCHID had two radiotelephones in the wheelhouse. The first unit inspected was an ITT Marine STR 65. The power measured 25 watts output and the antenna system was good. In radio checks with the Coast Guard on channel 16, the frequency checked out satisfactorily. Channel 13, the bridge-to-bridge frequency, was also checked. The power output was 25 watts and a radio check with another vessel proved satisfactory. However, when the unit was switched to low power, it measured 0 (zero) watts. When the FCC inspector depressed the transmitting button, he found no power to the antenna. He passed this information on to the ship's radio operator.

The inspector stated that this condition would not affect the ability of the unit to receive on whatever channel it was set. To check the frequency of the channels in question, he asked for a signal report from the Coast Guard and the other vessels he contacted. The signal reports indicated "loud and clear," so no further check was made.

The second unit, a NERA, was also set up by the ship's radio operator for demonstration. The FCC inspector measured the transmitter's high-power output; it read 0.08 watts, virtually no output. He attempted to make a call, but received no response. There was no indication that the receiver was working. The ship's master, during his testimony, stated that the ITT unit had been installed to replace the NERA unit, which had never been removed.

The inspection of the VHF-FM radiotelephone system in the pilothouse of the Staten Island end of the AMERICAN LEGION was conducted in a similar manner. There were two identical units in the pilothouse manufactured by Motorola, one labeled "main" and the other "standby." The main unit was checked first using channels 6, 13, 16, and 19A. The inspector spoke with the Staten Island ferry terminal dispatcher's office on channel 19A and the Coast Guard on channel 16. Both reported receiving the transmissions "loud and clear." The power output was measured at 25 watts. The antenna system was good. The standby unit was checked in the same manner with satisfactory results.

The portable VHF-FM radio used by the pilot of the HØEGH ORCHID was inspected by Coast Guard radio technicians. This unit was an RCA Personalfone 150. It was checked for power, transmitter frequency, and receiver sensitivity on channels 13 and 18. The power output on both channels was 0.7 watt. Both transmitting channels were 550 Hz low from the center of the frequency but were within the frequency tolerance of 1,500 Hz. The receiver sensitivity was reported adequate for the set's intended use.

On May 7, 1980, both radars aboard the HØEGH ORCHID were examined by a radar technician from the Raytheon Marine Company. The 3-cm (x-band) model 1220/6xB radar was found to be "normal in all respects." Tuning was proper and sensitivity was good with reception to less than 100 feet. The 10-cm (S-band) model 1650 was found to be operating properly with good sensitivity except at less than 1/2 mile. At less than 1/4 mile there were no echos (contacts), while between 1/4 to 1/2 mile, only the strongest echos could be received. This apparent defect was due to a faulty capacitor in the sensitivity time control (STC) circuit. This circuit, sometimes referred to as sea return suppression or sea anticlutter control, is used to eliminate sea return which could otherwise mask the stronger echos of ships or buoys by reducing the gain of the radar receiver.

Other Information

New York City Ferry Service.—The city of New York provides ferry services for both passengers and vehicles between Staten Island and The Battery. This service has been continuous for over 75 years. The New York City Department of Marine and Aviation operates five ferries over the 5-mile route. During the morning and evening "rush hour" periods, they carry approximately 21,000 passengers. About 57,000 passengers per day use the Staten Island ferries. The AMERICAN LEGION is certificated to carry 3,533 persons and normally carries about 3,000 passengers during the peak periods. No other ferry system in the country carries as many people on one vessel as a Staten Island ferry.

The five ferries leave every 15 minutes during the morning "rush hour" period from 0600 until 0930 at which time all but two are idle until the evening "rush hour." Five ferries operate from 1640 to about 1900 after which a two-boat schedule is maintained until midnight. After midnight one ferry operates until 0600 the next morning. During periods of low visibility, the "rush hour" departure schedule may be extended to every 20 minutes. Normally, in clear weather a ferry makes the crossing in 22 to 25 minutes. With the additional time required to dock, unload and load passengers, and undock, the round trip takes about 1 hour.

A supervisor's office in the Staten Island ferry terminal dispatches the ferries and maintains communications with each operating ferry 24 hours a day. Terminal supervisors on the Manhattan and the Staten Island sides are responsible for loading the ferries. Terminal employees monitor the turnstiles continually during "rush hour" periods and hourly at other times. When sufficient passengers for a ferry load, usually about 3,000 to 3,200, are in the waiting room, the turnstiles are roped off until the ferry is loaded and the doors to the ramps are closed.

Vehicles are loaded aboard the ferries from the lower level of the terminal over a gangway to the main deck. The ferry's mate supervises the loading of the vehicles which are driven aboard into the three lanes provided.

The Staten Island ferries operate every day of the year including holidays and in all weather conditions. The only time service has been interrupted significantly was during extremely high tides when the passenger and vehicle ramps could not be raised to the level of the ferry's decks.

Recently, several additions to the Staten Island ferry fleet have significantly increased the passenger-carrying capacity of the system. These newer vessels have been certificated by the Coast Guard to carry over 5,000 passengers.

New York Vessel Traffic Service.--The term "vessel traffic service" or VTS, when viewed in its broadest sense, includes any program, system, or regulation to make the use of ports and waterways by vessel traffic safer. Aids to navigation such as buoys, lighthouses, fog signals, electronic navigation devices, traffic separation schemes, bridge-to-bridge radiotelephone regulations, regulated navigational areas, and dredged channels are all forms of vessel traffic services. However, radar and television surveillance, vessel movement reporting systems, and traffic control centers are the more commonly recognized forms of vessel traffic services.

The Safety Board supported passage of the Ports and Waterways Act of 1972 (33 USC 121-1227), which provided authority to broaden the vessel traffic service concept to include the application of more sophisticated vessel traffic management techniques. Under this act, the U.S. Coast Guard was charged with the responsibility for conducting a comprehensive analysis of all the necessary elements of these new techniques. Since 1970, the Safety Board has issued approximately 26 recommendations directed toward improving the effectiveness of VTS in the major U.S. ports and waterways.

In 1972, an informal committee was formed with representatives of the maritime industry which included the local port authority, pilots, steamship owners and operators, labor groups, prominent individuals in the maritime industry, and the Coast Guard to discuss the formation of a New York Harbor Vessel Traffic Service Advisory Committee. A permanent committee was appointed by the Secretary of Transportation to provide the local viewpoints in the formation of the proposed regulations. After public comment, the regulations were adopted in 1978 (Subchapter P, Title 33, Code of Federal Regulations) and the New York Vessel Traffic Service Manual was published in 1979.

In the August 1973 U.S. Coast Guard study, "Vessel Traffic Systems Analysis of Port Needs," New York was ranked as the first port in a priority composite for a fully operational VTS system. The study included VTS-level recommendations for five sectors. Currently, the VTS for the Port of New York is not fully operational even though the system has two installed land-based radar sites; six low-light-level television sites for surveillance of the Lower and Upper Bays in New York Harbor and critical points in Arthur Kill, Kill Van Kull, and the East River; a manned traffic center; and a VHF-FM communications system (multisectored channels 11, 12, and 14). The Commanding Officer of the Coast Guard New York Vessel Traffic Center (VTC) stated that a fully operational VTS was originally scheduled for 1977. Since then, there have been several proposed commissioning dates, the last attempt in September 1980. Recent information indicates that for budgetary reasons a fully operational VTS for the Port of New York may not be possible until the mid-1980's or later. The VTS computer hardware furnished by the contractor has failed to meet the contract specifications and the Coast Guard has decided not to place the VTS into full operation until another computer is available or another method to manage traffic is found.

Currently, a Coast Guard unit, consisting of 15 persons, mans the VTC on a 24-hour basis. As a result, the VTS on Governor's Island is limited to maintaining oversight on the vessels in the Federal anchorages and providing a limited traffic manager service for the Captain of the Port in emergencies or for special harbor operations.

Bridge-to-Bridge Radiotelephone Regulations.--The HØEGH ORCHID and the AMERICAN LEGION were both subject to the bridge-to-bridge radiotelephone regulations, 11/ which are administered by the U.S. Coast Guard. A designated frequency

11/ Vessel Bridge-to-Bridge Radiotelephone Act of 1972, 33 CFR, Part 26, Section 26.01-26.10.

of 156.65 mHz, channel 13, was assigned by the FCC as a navigational frequency for the exclusive use of the master or person in charge who directs the movement of a vessel.

The HØEGH ORCHID's VHF-FM radiotelephone was set on channel 13 in the high-power mode during the trip into the harbor from the pilot station. It also was set to monitor 156.8 mHz, channel 16, the distress, safety, and calling frequency. It was switched to channel 12 after the collision when the pilot reported the accident to the Coast Guard's VTC. The pilot's portable radio was set on channel 13, which he used almost exclusively in the low-power mode during the inbound trip.

The AMERICAN LEGION's VHF-FM radiotelephone was set on channel 13 on the morning of the collision. In addition, it was also set to monitor channel 19A, the frequency used by the ferry dispatcher to communicate with the vessels in the Staten Island ferry system. This system allowed the ferry master to transmit on either frequency when the appropriate selector switch was depressed and to simultaneously receive in both frequencies. A standby radiotelephone that duplicated the main units was installed in each pilothouse.

The AMERICAN LEGION did not monitor channel 16, because under an exemption granted by the FCC to the city of New York on November 4, 1959, and revised on June 7, 1965, the ferry fleet was not required to maintain a listening watch on 156.8 mHz (channel 16). In lieu of such listening watch, the city of New York under its Department of Marine and Aviation established a limited coast station located at the Staten Island terminal. This station is manned by qualified radio operators with the means (channel 19A) to immediately alert the vessels to any emergency communication of which they should be aware.

Pilot Rules for Inland Waters.--As the HØEGH ORCHID proceeded inbound in Ambrose Channel, it crossed the demarcation line for the Inland Rules. The Inland Rules of the Road and the regulations (Pilot Rules) established pursuant thereto have the following requirements for vessels operating during periods of reduced visibility:

33 CFR 93.12 Fog Signals

In fog, mist, falling snow, or heavy rainstorms, whether by day or night, signals shall be given as follows:

(a) A steam vessel under way, except when towing other vessels or being towed shall sound, at intervals of not more than 1 minute, on the whistle or siren, a prolonged blast.

* * *

33 CFR 93.13 Speed in Fog

(a) Moderate speed in fog. (1) Every steam vessel shall, in a fog, mist, falling snow, or heavy rainstorms, go at a moderate speed, having careful regard to the existing circumstances and conditions.

(2) A steam vessel hearing, apparently forward of her beam, the fog signal of a vessel the position of which is not ascertained shall, so far as the circumstances of the case admit, stop her engines and then navigate with caution until danger of collision is over.

* * *

33 CFR 93.1 Danger Signal

If, when steam vessels are approaching each other, either vessel fails to understand the course or intention of the other, from any cause, the vessel so in doubt shall immediately signify the same by giving several short and rapid blasts, not less than four, of the steam whistle, the danger signal.

According to testimony given by the pilot and the officers of the HØEGH ORCHID who were on the bridge at the time, fog signals consisting of one prolonged blast at intervals not exceeding 1 minute were sounded. The AMERICAN LEGION was also sounding fog signals as required by the Inland Rules of the Road. The ferry master stated that he operated the whistle control manually during the entire period after leaving the terminal.

The master and pilot of the HØEGH ORCHID agreed to proceed into the harbor at half speed (12 knots). The master testified that he believed that, because of the controllable-pitch propeller, the vessel was very maneuverable and could stop in a short distance; therefore, he considered this speed reasonable. The pilot believed that the radars were working very well and that, since there was little or no traffic in the channel, the speed was safe.

The master of the AMERICAN LEGION testified that he only used slow speed from the terminal to the KV buoy and then rounded the buoy with engines stopped, drifting into the main channel with the way that remained.

ANALYSIS

The Collision

Upon arrival at the pilot station at the entrance to New York Harbor, the HØEGH ORCHID had completed a 2-day voyage in dense fog. It made the approach to the pilot station, boarded a pilot at 0555 approximately 1 nmi east of the sea buoy at the entrance to Ambrose Channel, and proceeded up the Ambrose Channel without incident. The master and pilot agreed that half ahead was a safe speed to navigate the 2,000-foot-wide channel in fog because both radars were functioning properly and there was little vessel traffic. According to the table of propulsion settings and the associated speeds for the HØEGH ORCHID, the half ahead speed is 12 knots. Although a full range of propulsion settings and associated speeds was posted in the wheelhouse for the pilot's use, he gave orders in the established practice of half ahead, slow ahead, and dead slow ahead. The various speed increments available between these settings were not utilized.

The HØEGH ORCHID passed under the Verrazano-Narrows Bridge at 0701. Based on a distance of 12.25 nmi from the sea buoy to the bridge, the average speed was 11.14 knots. After passing the Verrazano-Narrows Bridge, the pilot reduced the vessel's speed to slow ahead (9 knots) and dead slow ahead (5 knots) to allow the TILLY, the inbound vessel ahead, to clear the main channel and proceed into the Bay Ridge Channel. He then increased the speed to half ahead, followed immediately by slow ahead. The Safety Board believes that the pilot, believing that reducing to slow ahead was a sufficient reduction in speed to proceed in the Upper Bay, did not realize that the established slow ahead speed on the HØEGH ORCHID was actually 9 knots.

Lloyd's Register of Shipping indicates that the sea speed of the HØEGH ORCHID is 17 knots. According to the table of propulsion settings posted in the wheelhouse, the maneuvering full ahead speed is 14 knots. A speed of 9 knots is considerably more than what would be expected when ordering slow ahead on a vessel capable of the aforementioned speeds. On vessels with fixed-pitch propellers, where speed is controlled by revolutions per minute (rpm), a slow ahead order is normally established to be about one-third of maneuvering full ahead speed. The HØEGH ORCHID's controllable-pitch propeller, however, produces thrust by varying both pitch and rpm with 15 available propulsion settings. Using the same criteria, one-third of the HØEGH ORCHID's maneuvering full ahead speed of 14 knots would be approximately 5 knots, or a propulsion setting of 1.5 on the vessel's speed control lever.

Although the pilot discussed the ship's maneuvering characteristics with the master when the pilot first took the conn, the Safety Board believes that the distance required to stop the vessel dead in the water from slow ahead was never mentioned. If this fact had been discussed, the significance of the slow ahead speed might have been more obvious to the pilot. Based on the times recorded in the HØEGH ORCHID's bellbook, the average speed of the vessel from the Verrazano-Narrows Bridge to the vicinity of buoy No. 24 was more than 10 knots. Speed in fog has historically been a concern in collision avoidance. Moderate speed cannot be expressed definitely in terms of knots, but is rather a speed which will allow sufficient time to hear fog signals and take appropriate action to reduce the likelihood of collision. At a speed of 9 knots, the HØEGH ORCHID advanced over 912 feet (0.15 nmi) per minute. Although the master of the HØEGH ORCHID testified that with the controllable-pitch propeller his vessel was highly maneuverable, the fact remains that the vessel did not stop in time to avert the collision with the AMERICAN LEGION. The Safety Board believes that the HØEGH ORCHID's speed of 9 knots was excessive in the prevailing fog conditions. Although the pilot took evasive action when he became aware of the close proximity of the ferry, the effects of the action were limited by the vessel's excessive speed.

The HØEGH ORCHID sounded fog signals at the prescribed intervals, according to the testimony from those persons on the bridge. As the vessel crossed the demarcation line for international and inland waters, the interval was changed from 2 minutes to 1 minute. The individual testimony of the pilot, master, and chief officer vary slightly as to where the vessel was when this was done; however, all agree that it was sometime before passing under the Verrazano-Narrows Bridge.

The AMERICAN LEGION departed the Staten Island ferry terminal with only the radar on the Staten Island end operable. Although this condition in itself did not contribute to the accident, the action by the ferry to turn around and reverse direction to put the Staten Island end toward Manhattan placed it north of the KV buoy where it would not normally go on the northbound route. The testimony of the ferry master and the ferry's pilot indicated that the normal practice after departing the Staten Island ferry terminal is to steer for buoy No. 24 and cross the main ship channel before heading north toward Manhattan. After the ferry's lookout sighted the KV buoy, the ferry master sighted a contact on his radarscope near his starboard beam about 1/2 mile distant. Although he had not made any evaluation, he nevertheless stopped his engine and broadcast another security call. As the ferry rounded the buoy and changed compass heading from east-northeast (067 1/2°) to east (090°), the presentation on the ferry's radarscope (which was not gyrostabilized) rotated to the left. The vessels were closing at a speed of 11 knots or about 1,100 feet per minute. The interval in which the HØEGH ORCHID first appeared on the AMERICAN LEGION's radarscope until collision was about 2 1/2 to 3 minutes. During this period, the ferry master should have evaluated the

contact to determine its relative motion. It would have been apparent that the HØEGH ORCHID was closing rapidly which should have alerted the ferry master to the possibility that risk of a collision existed even though circumstances did not permit him to calculate the closest point of approach (CPA). The ferry master said he sounded a fog signal but, hearing no answering signal from the direction of the radar contact, concluded that it posed no threat to him. He made no further assessment of radar information to determine the HØEGH ORCHID's movements. Merely sounding a fog signal, when a contact appears on the radarscope, does not satisfy the basic navigational requirement for determining if a risk of collision exists and taking sufficient action to avoid it. It was not until one of the ferry's lookouts on the upper deck shouted "ship on the starboard beam" that the ferry master realized his vessel was in danger and took evasive action. By ordering full ahead on the ferry's engines and hard right rudder, he intended to maneuver his vessel out of the path of the HØEGH ORCHID. While the attempt failed to prevent the collision, it may have lessened the impact by swinging the stern away from the oncoming vessel. No danger signal was sounded by the ferry. The Safety Board believes that because of the various course changes he made, the ferry master was unable to evaluate the relative movements of the HØEGH ORCHID and the AMERICAN LEGION based on his radar presentation.

As the HØEGH ORCHID passed buoy No. 22 the pilot heard the AMERICAN LEGION's security call announcing that it was "coming up on the KV buoy heading for buoy 24." Although the HØEGH ORCHID was less than 1 mile from buoy No. 24, the pilot apparently had not yet noticed the ferry on his radar. Although the postaccident examination of the radar revealed that the HØEGH ORCHID's 10-cm radar had a malfunction in the anticlutter control circuit (STC) at less than 1/2 mile range, this should not have prevented the ferry contact from being seen earlier. The two vessels anchored at the northern end of the Stapleton anchorage, a tug and tow approaching buoy No. 24 heading east toward Bay Ridge, and the EDITA, anchored in the Bay Ridge anchorage about 300 to 400 yards east of buoy No. 24 were all visible on the HØEGH ORCHID's radars. The HØEGH ORCHID's pilot was unaware that the AMERICAN LEGION, having left the Staten Island ferry terminal and turned toward the Kill Van Kull before reversing course, was headed for a point north of the KV buoy. The radar contacts that were outside of the buoys along the main ship channel did not pose any apparent threat to the HØEGH ORCHID, and probably did not engage the pilot's attention. It was only when the ferry entered the main channel that he became concerned and, given a minimum time for evaluation, made his decision to take evasive action as soon as he identified the ferry. If the ferry had been equipped with a transponder or similar device that enhances the display on the radars of other vessels and provides positive identification, the ferry's identity could have been distinguishable from other harbor traffic and identified by the HØEGH ORCHID.

The full astern and hard right maneuver slowed the HØEGH ORCHID to about 3 to 4 knots at the time of the collision, reducing the force of the impact, and probably prevented damage to the ferry below the waterline. Although the ferry's master had broadcast his intentions to head for buoy No. 24, the pilot of the HØEGH ORCHID continued toward the same buoy without any further reductions in speed even though the risks were increasing. The Safety Board believes that the HØEGH ORCHID's speed in almost zero visibility was excessive for the waterway being transited.

Master-Pilot Relationship

When the Sandy Hook pilot first boarded the HØEGH ORCHID, a relationship between pilot and master was established that continued throughout the entire period until he was relieved by the docking pilot. The vessel's master, in turning over the conn to

the pilot, did not relinquish his authority as master, and remained in command of the vessel. Both mariners had the same ultimate goal, to navigate the vessel over the pilotage route in a safe and expeditious manner.

The master of the HØEGH ORCHID continued to verify the ship's position and was constantly observing that helm orders and engine maneuvers given by the pilot were properly executed. The Sandy Hook pilot was a compulsory pilot, placed aboard by the State to navigate the vessel in pilotage waters. The ship's master or his agents do not participate in the selection of the pilot and the pilot is not bound by the owner's commercial interests. Under questioning during the hearing, the master stated that he was not under any pressure to maintain a schedule although there were longshoremen ordered to work the vessel at 0800. Testimony from both the pilot and the master indicated that the decision to continue in fog and not anchor was a mutual agreement. At no time did the master countermand the pilot's orders or attempt to relieve him of the conn. The Safety Board believes that the actions of the Sandy Hook pilot on the morning of May 6, 1981, were agreed to by the master of the HØEGH ORCHID.

New York Vessel Traffic Center

The existing Vessel Traffic Center (VTC) has the capability to acquire pertinent information from vessels intending to navigate during periods of severely reduced visibility in the sectors which the ferry routes traverse, to monitor vessel movements, and to provide vessel movement information to ferry operators. The VTC radar can provide more accurate and reliable collision avoidance information than many shipboard radars, especially those which are not gyrostabilized, because its true-motion display simplifies interpretation of vessel movements, and the greater height of its antenna reduces radar shadow effects. Vessels intending to transit the ferry route sectors could advise the VTC of their intended movements and progress. The VTC personnel could verify a vessel's reported position on radar and then monitor its movements while it is navigating through the sectors of concern. A ferry operator or dispatcher could then obtain information about expected vessel movements near the ferry route before the ferry departs its slip.

Recognizing that activation of a harbor-wide VTS lies well in the future, the Safety Board believes that the Coast Guard should evaluate how the existing VTC resources can be effectively utilized to insure the safety of ferry passengers in Upper New York Bay. As a minimum, the VTC should be used to assist vessels navigating near the ferry routes when severe weather conditions, such as dense fog, exist. This would require some form of traffic management and advisory service such as that described in the "New York Vessel Traffic Service Operating Manual" dated September 1979. The Safety Board believes that the equipment and the staff currently available at the New York VTC could be effective in this limited role.

Vessel movements in Upper New York Bay, except for ferry movements, are significantly reduced during dense fog, since many pilots and masters elect to anchor until visibility improves. The Safety Board believes that the existing VTC equipment can provide the essential advisory data to enhance the safety of ferries navigating in fog. Working together with the Captain of the Port, the numbers of vessels near the ferry route could be limited when necessary to a level within the VTC capability.

Security calls were broadcast by the pilot of the HØEGH ORCHID over his portable radio on channel 13. The portable radios carried by pilots fulfill the bridge-to-bridge radio requirements for foreign vessels in U.S. waters. Although he testified that he made several security calls after the one at 0701 when the HØEGH ORCHID passed under the

Verrazano-Narrows bridge, the transcript of the VTC tape recording of channel 13 on the morning of May 6 did not so indicate. There was recorded communication on the VTC tape between the pilots of the TILLY and the HØEGH ORCHID starting at 0703 until 0705 that verified that the portable radio was operating. The transcript contains no further transmissions from the HØEGH ORCHID until 0718, 2 minutes after the collision. However, transmissions from the pilot of the EDITA calling "the vessel inbound at the 22 buoy main ship channel" at 0710 1/2 and "calling the vessel inbound abeam of the 22 buoy" at 0712 were recorded, but no response to these calls was recorded. The investigation revealed that the only vessel in the vicinity of buoy No. 22 in the main ship channel at that time was the HØEGH ORCHID. It could not be determined why the master and pilot failed to respond to the calls from the EDITA, but the Safety Board believes that if the HØEGH ORCHID had been called by name, those persons in the wheelhouse would have heeded the EDITA's call. Security calls, by themselves, do not provide the originator with the assurance that he has been heard. Only when two-way communications are established between vessels is there any assurance that these calls have been heard.

The Safety Board is aware of the excellent working relationship between the U.S. Coast Guard and the New York Harbor Vessel Traffic Service Advisory Committee, which represents those operators who will use the system when it is activated by the Coast Guard. Since the advisory committee's formation in 1972, it has consistently supported Coast Guard efforts to activate a fully operational VTS system. The committee's advice would be equally useful in determining how the VTC can be used in the interim to improve the safety of ferry operations during periods of low visibility. Because the risk of a potentially disastrous accident involving a ferry exists, on October 6, 1981, the Safety Board recommended that the Coast Guard:

> Assign a high budgetary and research priority to the establishment of a fully operational Vessel Traffic System in New York Harbor at the earliest time. (Class II, Priority Action) (M-81-82)
>
> Pending activation of a fully operational Vessel Traffic Service system for New York Harbor, and with the advice of the New York Harbor Vessel Traffic Service Advisory Committee, develop and implement a plan of action for the Captain of the Port of New York and the New York Vessel Traffic Center to coordinate traffic movements in the vicinity of ferry routes between Manhattan and Staten Island during periods of severely reduced visibility due to fog or other serious inclement weather conditions. (Class II, Priority Action) (M-81-83)

In November 1981, the Subcommittee on Coast Guard and Navigation of the Merchant Marine and Fisheries Committee, U.S. House of Representatives, issued an Oversight Report titled "Semi-Paratus: The United States Coast Guard, 1981." The hearing, which discussed marine safety and aids to navigation missions of the Coast Guard, resulted in a subcommittee recommendation that the "New York VTS system be made operational with existing equipment, and that needed new personnel be acquired."

The pilot who was aboard the EDITA while it lay at anchor in the Bay Ridge anchorage near buoy No. 24 saw the developing situation on his radar and attempted to contact the HØEGH ORCHID twice by radio over channel 13 to warn it of the ferry's presence. Although these transmissions were recorded by the VTC, the pilot of the HØEGH ORCHID did not respond, possibly because the vessel was not called by name or he did not hear the EDITA's pilot through the noise level of the radio traffic. The pilot aboard the EDITA stated that he tried to call the AMERICAN LEGION by name; however, this transmission did not appear in the transcript of the VTC tape recordings.

VHF-FM Radiotelephone

The use of the VHF-FM radiotelephone communication has become an important factor in the day-to-day operation of a port. Tugs are dispatched by radio, vessels can communicate directly with agents to conduct port business, and emergency situations can be quickly reported and responded to by proper authorities. In recognition of the great potential that this type of short-range radio communication could offer as a navigational safety tool, the Vessel Bridge-to-Bridge Radiotelephone Act was enacted by Congress and regulations were published that have been in effect since 1973 (33 CFR Part 26). The result is that operators of all but the smallest approaching vessels are required to have a means to communicate their intentions to each other through voice radio over a specific frequency or frequencies dedicated to the exchange of navigational information.

Both the HØEGH ORCHID and the AMERICAN LEGION were equipped with VHF radios that complied with the regulations. The pilot's portable radio was also capable of transmitting and receiving over channel 13 in the low-power mode. Although most shipboard VHF installations have both high- and low-power capabilities, there are many instances where vessel operators will use the high-power mode for close-in harbor communication such as security calls and other navigational information that will override any low-power transmissions. Important navigational exchanges between two approaching vessels can be partially or even totally obliterated by the use of the high-power mode by another vessel in the area. A partial message may leave the recipient misinformed of the intentions of an approaching vessel. This problem was determined to be a factor in the 1980 collision of the Coast Guard cutter BLACKTHORN and the U. S. tankship CAPRICORN. 12/

When the pilot of the HØEGH ORCHID broadcast the security call at 0701, as the ship passed under the Verrazano-Narrows Bridge, the AMERICAN LEGION had not yet departed the ferry slip on Staten Island. Although a VHF radio may have been operational on the ferry, no one reacted to the HØEGH ORCHID's security call. If the HØEGH ORCHID's pilot had made additional security calls after passing the bridge, it is possible the ferry master may have been alerted and could have then identified the HØEGH ORCHID on his radarscope. The ferry master continued to broadcast his position and intentions from the time that he left the terminal until he approached the KV buoy, but the significance of those security calls was not heeded by the pilot of the HØEGH ORCHID, nor did he identify the ferry on his radarscope until it passed the KV buoy into the main ship channel. An operational VTS in New York Harbor could have provided these vessels with the names of vessels they might encounter in the various sectors. Masters and pilots would probably be alerted better by a call citing their vessel's name than a general call.

The master of the AMERICAN LEGION, by not notifying Coast Guard Group New York on channel 16 (156.8 mHz) immediately after assessing the damage to his vessel, precluded the Coast Guard from fully evaluating the situation after it received notice of the collision from the pilot of the EDITA via the VTC. Although the master had the capability, he failed to call the Coast Guard and inform it of his status. The Safety Board believes the ferry master should have immediately informed the Coast Guard by radio of the accident and kept it advised as to his evaluation of the situation. Presently, the

12/ "Marine Accident Report--Collision of U.S. Coast Guard Cutter BLACKTHORN and the U.S. Tankship CAPRICORN, Tampa Bay, Florida, January 28, 1980" (NTSB-MAR-80-14).

Staten Island ferries do not have the capability to communicate with the VTC over channel 12 (156.6 mHz) which, under the present limited mission of the VTC, is the frequency it guards to monitor the Federal anchorages in Upper New York Bay. Even though the establishment of a fully operational VTS lies sometime in the future, the Safety Board believes that the Staten Island ferries should have the capability of communicating with the VTC on channel 12 to avail themselves of any pertinent information that the VTC may have.

Radar Interpretation

In analyzing the use of radar by the pilot of the HØEGH ORCHID and the master of the AMERICAN LEGION, it was evident that both parties apparently did not make effective use of all the radar information that was available to them. Both the master and the pilot of the HØEGH ORCHID were observing the two radars, each using both units at one time or another. The malfunction subsequently found in the 10-cm radar within the 1/2 mile range probably did not contribute to the cause of the accident. Although the 10-cm radar was used to get an overall picture of the harbor, it was not being used effectively. When the master of the AMERICAN LEGION broadcast a security call at 0711, the pilot of the HØEGH ORCHID should have attempted to identify the ferry on radar and to establish radio communication. The ferry's radar image should have been visible before 0.5 nmi. Because greater use was being made of the 3-cm radar, the traffic beyond 1 1/2 nmi shown on the 10-cm radar was not monitored as it should have been. With the 3-cm radar set on the 1 1/2-mile scale, the image of the AMERICAN LEGION would have begun to appear on the edge of the radarscope at about 0708 after it steadied up on the east-northeast course to the KV buoy. From this time until the collision, the ferry would have maintained approximately the same relative bearing on the HØEGH ORCHID's 3-cm radarscope. When the ferry first appeared on the HØEGH ORCHID's radars, the two vessels anchored at the northern end of the Stapleton anchorage would have been almost in line with the ferry's image; however, the resolution in range of the 3-cm radar should have been sufficient to portray each image distinctly. Because of the relatively small size of the ferry compared to the anchored vessels, it is possible that its radar image may not have been as noticeable. However, from about 0709 to 0713 1/2, the range was less than 1 1/2 nmi; therefore, the ferry should have been displayed on both of the HØEGH ORCHID's radars and then on the 3-cm radar alone from 1/2 nmi up to the collision. No other images should have interfered with the radar display. The effectiveness of navigational radar would be greatly improved if it provided positive identification of ferries. Radar beacons (racons) are commercially available transponders which, when triggered by a radar signal, send back a response which appears on the receiving ship's radarscope as a bright line extending beyond the contact. This distinguishes the racon-equipped contact from the remainder of the display. Racons operate in the 3-cm and 10-cm radar bands and are currently being used on waterways in conjunction with other navigational aids. The use of transponders aboard vessels to enhance radar return has been determined to be feasible by the U.S. Maritime Administration. The Safety Board believes that a study should be made by the Coast Guard to evaluate the merits of installing basic transponders or similar devices on the New York ferries so that they may be positively identified on 3-cm and 10-cm radars.

When the HØEGH ORCHID's image first appeared on the ferry's radarscope, the ferry master could not identify it as a "definite target." He testified that it did not appear to be moving, although he first saw it at 1/2 nmi on his starboard beam and then at 1/8 nmi. He stated that only when it was at a range of 1/8 nmi did it appear to move. The apparent motion of the HØEGH ORCHID as seen on the ferry's nonstabilized radarscope would have been of a vessel closing rapidly and, coupled with the course

changes of the ferry (as it rounded the KV buoy), would have produced a smudged trail of images with each sweep of the antenna. The images of the other contacts on the ferry's radar would have appeared sharper and more distinct because their slower relative motion permitted these images to be reinforced during several sweeps of the antenna. Thus, even without plotting, the ferry master should have determined that the HØEGH ORCHID's relative speed was far in excess of any other contact on the radarscope. Therefore, the Safety Board concludes that the master of the AMERICAN LEGION failed to correctly interpret the display on his radarscope that indicated a vessel was rapidly closing on a collision course and to take appropriate action to avoid the accident.

With the addition of larger capacity vessels in the Staten Island ferry fleet, the number of passengers in transit, especially during the "rush hour" periods, will ultimately increase. Any upgrading of the ferry system also should include a review of the type of equipment and the methods used to navigate the ferries over the established route. The modern collision avoidance systems and stabilized radars that are available together with a modern gyrocompass would provide additional navigational safety for the passengers and greatly enhance the all-weather capabilities of the ferries.

The master of the AMERICAN LEGION testified that with the present method of navigating the ferries, plotting of targets on a radarscope is not done nor is it practical. With the present equipment in the pilothouse of the ferries, this may be a reasonable conclusion. The basic function of radar in limited visibility is to provide information to the observer that can be used to determine if the risk of collision exists with one or more approaching vessels. To achieve this with any degree of accuracy depends on the ability of the operator to reduce radar contact error. It is difficult to observe accurate radar bearings when the vessel is not held to a steady course or when it is in a yawing condition. Radar ranging or distance measuring is not affected by the yawing effect. Presently, the radar observer on the ferries must request the compass heading from the pilot or helmsman while he obtains a relative bearing of a contact on the radar. To make a projection of its relative motion, another bearing must be taken after an interval of time. Because the nonstabilized presentation on the radarscope rotates with any change of heading of the vessel, the radar observer must again request a compass heading from the helmsman and apply any angular difference between this heading and the heading of the vessel at the time of the first bearing. Meanwhile, because the heading of the vessel may not be steady enough to allow a clear image to be imprinted on the radarscope, a blurred radar image may result. If multiple contacts are present, which most likely would be the condition in New York Harbor, the process is time-consuming and requires complete concentration by the observer. Meanwhile, the same radar is also used to determine courses to steer and to monitor navigational aids. As a result, the effectiveness of the ferry's radar as an anticollision device is limited.

If the ferries were equipped with a gyrocompass, radar contact error could be significantly reduced. A radar, stabilized with a gyro input, would be more effective in monitoring radar contacts. It would also give the ferry master the means to further utilize the advantages of a gyrocompass by establishing courses to steer directly from the gyrostabilized radar during periods of limited visibility in a more accurate manner. Providing a gyro input to the radar unit would also furnish a key element necessary for adding an automatic radar plotting aid (ARPA).

The Safety Board believes that the city of New York, through its Department of Marine and Aviation, should provide and install gyrocompasses aboard the Staten Island ferries and upgrade the radar units aboard the ferries to include a gyrostabilized presentation and that the Coast Guard should withdraw the deviation permitting the

ferries to operate without a gyrocompass and illuminated gyrocompass repeater and require this equipment to be installed. The Safety Board further believes that an evaluation should be conducted to determine the feasibility of the use of an ARPA in conjunction with the stabilized radar presentation.

The ferry master's Coast Guard license included an endorsement as radar observer, inland. This license was renewed on March 30, 1981, about 2 months before the accident. At that time, in addition to an abbreviated rules of the road examination, the master was required to pass a radar examination or present a certificate of successful completion from an approved radar school to qualify for renewal. Having failed the Coast Guard radar examination, he attended a 1-day course at a radar school and was given a certificate which he presented to the Coast Guard.

Investigation of examination records revealed that the majority of renewal applicants attend some type of approved radar school rather than take the Coast Guard examination, and over half of those taking the Coast Guard examination failed. A Coast Guard license examiner testified that in an 18-month period, 57 percent of those taking the Coast Guard's radar examination failed. The radar schools use more of an instructional-type approach with lectures, plotting techniques, and actual practice on a radarscope followed by an examination. The Coast Guard radar examination does not offer any "hands-on" type of demonstration, but uses a problem and solution type of approach.

The inland and ocean radar examinations given by the Coast Guard differ slightly. Solutions to the ocean radar observer questions usually require a substantial course change, whereas the inland solutions require more speed changes, recognizing that restricted waters do not permit large course alterations. There is little in the inland radar examination that relates to those mariners who operate in rivers and harbors and do not practice radar plotting. In the day-to-day job of navigating the Staten Island ferry in Upper New York Bay, the ferry master seldom plots on his radarscope to determine a contact's course and speed or closest point of approach (CPA). When he renews his license every 5 years, the Coast Guard does not examine him for knowledge of the special radar problems that he encounters in a harbor.

In 1968, the Safety Board published a special study 13/ with recommendations to the Coast Guard to:

> Amend the regulations to require a demonstration of knowledge of radar, to include plotting, by an examination or exercise by deck officers at the time of each renewal of license. (M-69-1)
>
> Increase the scope of existing regulations to require that applicants for license as pilot or as master or mate, on waters other than ocean or coastwise, be included in the requirement to demonstrate by professional examination their qualifications as radar observer. (M-69-3)

On August 21, 1970, the Coast Guard responded, in part:

> On 5 May 1970, amendments to Title 46 of the Code of Federal Regulations pertaining to the licensing of merchant marine officers and the

13/ "Study of Collisions of Radar-Equipped Merchant Ships and Preventive Recommendations," December 18, 1968.

> the manning of vessels were accepted by the Merchant Marine Council and will be published in the Federal Register in approximately three months. The amendments require that every pilot and deck officer, who holds a "radar observer" endorsement, must demonstrate his proficiency in radar prior to renewal of his license. . . . The same amendments also extend existing regulatory requirements, that all pilots and deck officers on board radar-equipped, inspected vessels of 300 gross tons and over [on] ocean, coastwise and Great Lakes routes hold a radar endorsement, to the same vessels on U.S. inland water routes as well.

Federal Register, Vol. 35, No. 252 amended the regulations (46 CFR 10.05-46) effective July 1, 1972.

Recent proposals by the Coast Guard to amend the regulations governing the issuance and renewal of radar endorsements have partially responded to the need for a demonstration of radar skills in order for a merchant marine officer to renew his license. The need for simulator training instead of relying on written examinations to demonstrate radar skills is the primary thrust of the proposed amendments. However, they do not recognize the type of proficiency required by those radar observers who operate harbor craft such as ferries. The Safety Board concludes that any curricula for radar observer training that would be developed by the Coast Guard for radar observer, inland waters, should include instruction and practical demonstration in the type of proficiency needed to safely navigate harbor craft in restricted waters.

CONCLUSIONS

Findings

1. The HØEGH ORCHID was piloted into New York Harbor in a dense fog at an excessive rate of speed without due regard for the prevailing conditions.

2. The HØEGH ORCHID's propulsion setting for slow ahead represented a speed of 9 knots which is excessive as compared to the speed customarily associated with the designation "slow ahead."

3. The pilot of the HØEGH ORCHID should have broadcast additional security calls after passing the Verrazano-Narrows bridge.

4. The pilot of the HØEGH ORCHID apparently did not hear the radio calls broadcast by the pilot of the anchored vessel EDITA.

5. The evasive action taken by the pilot of the HØEGH ORCHID when he realized the two vessels were in imminent risk of collision probably reduced the severity of the accident.

6. The master of the HØEGH ORCHID acquiesced in the actions of the Sandy Hook pilot on the morning of May 6, 1981.

7. The master of the AMERICAN LEGION was unable to properly evaluate the radar information available to him.

8. The pilot of the HØEGH ORCHID failed to evaluate, in a timely manner, the radar information available to him.

9. A danger signal should have been sounded by the AMERICAN LEGION when its master first became aware that a risk of collision existed.

10. The full ahead speed and hard right rudder ordered by the ferry's master moments before the collision probably reduced the damage to the vessel and injuries to the passengers by placing the AMERICAN LEGION in a turning motion to the right, swinging the starboard quarter away from the oncoming vessel.

11. The master of the AMERICAN LEGION should have notified the Coast Guard immediately by radio for its evaluation of the situation.

12. The collision between the HØEGH ORCHID and the AMERICAN LEGION might have been prevented if a limited VTS had been in operation pending activation of a fully operational VTS for New York Harbor.

13. An operational VTS would have provided the pilot of the HØEGH ORCHID and the master of the AMERICAN LEGION with specific information about vessels that were transiting the VTS sector on the morning of May 6, 1981.

14. The malfunction of the HØEGH ORCHID's 10-cm radar below the 1/2-mile range did not contribute to the accident.

15. The malfunction of the ITT VHF-FM radiotelephone aboard the HØEGH ORCHID did not contribute to the cause of the accident.

16. The U.S. Coast Guard radar examinations given to licensed deck officers as a requirement for license renewal do not adequately test the operators of ferries and other harbor craft in their particular type of operations.

17. Security calls by themselves, although an important navigational safety factor, do not assure the originator that other vessels are aware of his vessel's presence and do not relieve him of his obligation to navigate cautiously.

18. There is no evidence that any malfunction of navigational equipment, steering systems, or propulsion systems aboard either vessel contributed to the accident.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the accident was the excessive speed of the HØEGH ORCHID in dense fog and the failure of the master of the ferry AMERICAN LEGION and the pilot of the HØEGH ORCHID to properly evaluate the information displayed on their radarscopes and take appropriate action to avoid collision. Contributing to the accident was the failure of the pilot of the HØEGH ORCHID to establish radio communication with the AMERICAN LEGION in order to establish a meeting agreement after becoming aware that the ferry was entering the main shipping channel.

RECOMMENDATIONS

During its investigation of this accident, the National Transportation Safety Board made the following recommendations to the U.S. Coast Guard on October 6, 1981:

Assign a high budgetary and research priority to the establishment of a fully operational Vessel Traffic System in New York Harbor at the earliest time. (Class II, Priority Action) (M-81-82)

Pending activation of a fully operational Vessel Traffic Service system for New York Harbor, and with the advice of the New York Harbor Vessel Traffic Service Advisory Committee, develop and implement a plan of action for the Captain of the Port of New York and the New York Vessel Traffic Center to coordinate traffic movements in the vicinity of ferry routes between Manhattan and Staten Island during periods of severely reduced visibility due to fog or other serious inclement weather conditions. (Class II, Priority Action) (M-81-83)

As a result of this investigation report, the National Transportation Safety Board made the following additional recommendations:

—to the U.S. Coast Guard:

Evaluate the curricula of the approved radar schools to determine if the courses offered include training and testing in radar navigation as used by operators of ferries and other harbor craft, who do not normally plot radar contacts, and require those applicants seeking an endorsement as radar observer (restricted to inland waters), both original and renewal, to demonstrate this type of radar proficiency before such endorsement is issued. (Class II, Priority Action) (M-82-1)

Conduct a study to evaluate the feasibility of requiring the installation of a transponder or similar equipment that would identify the Staten Island ferries on all 3-cm and 10-cm radar units in current use aboard vessels. (Class II, Priority Action) (M-82-2)

Revoke the deviation from the equipment requirements of the Navigation Safety Regulations, 33 CFR 164.35, granted to the city of New York that permits the Staten Island ferries to operate without a gyrocompass and an illuminated gyrocompass repeater and require installation of this equipment. (Class II, Priority Action) (M-82-3)

--to the Department of Marine and Aviation, city of New York:

Provide the Staten Island ferries with the capability to transmit and receive over VHF-FM channel 12 to allow ferry masters to communicate with the New York Vessel Traffic Center. (Class II, Priority Action) (M-82-4)

Equip the Staten Island ferries with a gyrocompass and an illuminated gyrocompass repeater. (Class II, Priority Action) (M-82-5)

Modify the radar units to provide a gyrostabilized presentation so that the radar can be used more effectively to avoid collisions and as an aid to navigation. (Class II, Priority Action) (M-82-6)

Evaluate the benefits of an automatic radar plotting aid (ARPA) in the operation of the Staten Island ferries, particularly in periods of reduced visibility, and install the equipment if the evaluation is favorable. (Class II, Priority Action) (M-82-7)

—to the Leif Høegh Company

Review the appropriateness of the currently established maneuvering speeds of the HØEGH ORCHID. (Class II, Priority Action) (M-82-8)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ JAMES E. BURNETT, JR.
Acting Chairman

/s/ FRANCIS H. McADAMS
Member

/s/ PATRICIA A. GOLDMAN
Member

/s/ G. H. PATRICK BURSLEY
Member

Member FRANCIS H. McADAMS, concurring:

I would have cited both the master of the AMERICAN LEGION and the master and pilot of the HØEGH ORCHID in the probable cause for their decision to continue operations during conditions of zero visibility. The Inland Rules in effect at the time of the accident specified that a vessel operating in fog must proceed at moderate speed. The courts, in a long series of decisions, have interpreted "moderate speed" to mean a speed at which a vessel can be stopped in one-half the visibility. Obviously in zero or near-zero visibility a vessel cannot be stopped in one-half visibility. Therefore, any speed in such conditions is not moderate but is excessive. Assuming arguendo that decisions to continue operations are discretionary with the master or pilot, I submit such a decision was not reasonable or prudent in this case and should be cited as a contributing factor.

In my opinion, until there is mandatory and positive control of the movement of vessels in zero visibility, all operations should cease in narrow channels and ports where traffic volume is heavy. Radar-equipped vessels are not per se exempted from the rules of safe operations. In this case several radar-equipped vessels went to anchor, which was the prudent decision to make.

/s/ FRANCIS H. McADAMS
Member

February 2, 1982

APPENDIX

BRIDGE CONTROL SETTINGS INFORMATION POSTED IN WHEELHOUSE OF HØEGH ORCHID

M/S "HOEGH ORCHID".

TABLE OF CONTROL SETTINGS/RANGE OF SPEEDS FOR KaMeWa CONTROLLABLE PITCH PROPELLER.

NB. MANEUVERING SPEED/ FINE ADJUSTMENT PITCH CONTROLLER SET ON ZERO.

10 ... FULL AHEAD	14,0	Knots.
9	13,5	"
8	13,0	"
7	12,5	"
6 ...HALF AHEAD	12,0	"
5	11,0	"
4	10,0	"
3,5 ..... SLOW AHEAD	9,0	"
3,0	8,0	"
2,5	7,0	"
2,0	6,0	"
1,5 ..... DEAD SLOW AHEAD.....	5,0	"
1,0	3,0	"
0,5	1,0	"
0 ..... STOP	0	"

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